STIC Note

Low Cost ROV Solutions

BACKGROUND

The Science and Technology Innovation Center (STIC) team evaluated low-cost Remotely Operated Vehicle (ROV) systems to determine their utility for Coast Guard missions. An ROV is a tethered, underwater system that allows the vehicle's operator to remain in a comfortable environment, while the ROV functions in the conditions below the water's surface. Traditional ROV systems provide excellent capability, but at a very high cost which has limited the extent that the systems are currently being used. The Coast Guard's use has been restricted to those units with needs justifying their high costs, such as Marine Safety Response Team and Regional Dive Lockers. In recent years, with the emergence of very affordable remote electronics, the availability of a once-expensive technology has increased to the point where a hobbyist can purchase an ROV for under $3,000. The process is to determine if the capability they provide at the lower price point makes them cost effective tool for executing other CG missions.

METHODS

The STIC team conducted thorough market research that identified several different systems and identified two general form factors of ROVs. The first type is controlled with vectoring capabilities allowing the device to loiter in areas of interest; this style is well suited for inspection requirements. The second common ROV form factor is like a fixed wing aircraft in its movement, "flying" around the water in a primarily forward orientation; this style is useful for scanning a large area.

EVALUATION

The STIC team initially identified the best performing systems for each form factor by testing them in a pool at the US Coast Guard Academy. The devices were then evaluated in a real world environment in the Thames River in New London, CT. The team was able to identify pros and cons of each individual system, with criteria for performance including: maneuverability, ease of controls, sensor capabilities, and logistic considerations. Systems included in testing were the BlueROV2, CCROV, Fifish P3, Gladius, and the PowerRay (see table on back). Three promising systems were identified for a Limited User Evaluation (LUE): the BlueROV2, CCROV, and the Fifish. The ROVs were sent to four different CG units for LUE to determine their effectiveness to support CG missions.

CONCLUSIONS

All of the systems seem to have very capable cameras, but vectored thrusters allow the ROV to keep the camera on an object while countering currents. The availability of low-cost ROVs provides the Coast Guard the opportunity to increase its underwater situational awareness. ROVs are useful for inspections of ships hulls and appendages, docks and other infrastructure, or assisting in securing waterside events. The limitations of low-cost ROVs include difficulty navigating in high currents and poor visibility in murky waters.

Based on the user evaluations, low-cost ROVs that use vectored thrusters (such as the BlueROV2 and the CCROV) are probably most useful for CG operations. Costs have fallen low enough (and continue to go down) for Units to purchase these devices with unit funds.

	Max Depth (m)	Tether Length (m)	Video Quality	Control	Battery Life (Hours)	Cost ($K)	Comment
BlueROV2 	100m	50m	1080p HD	High	3-4	$4.5	4 horizontal thrusters provide vectored control; 2 vertical thrusters; Grabber arm; rotating camera
CCROV 	100m	50m	4k	High	3-4	$3.2	4 horizontal thrusters provide vectored control; 2 vertical thrusters; video and power over tether
FiFish P3 	100m	100m	4k, wide angle	Fair	4.5	$3.4	2 horizontal and 1 vertical thrusters
Gladius 	100m	100m	4k	Poor	3.5	$1.8	2 forward thrusters and 1 vertical
PowerRay 	30m	72m	4k	Poor	3.0	$1.4	2 forward thrusters and 1 vertical; video transmitted wirelessly from topside control box
Camera on a stick 	30m	30m	1000TVL	Limited	5.0	$0.260	6-24 foot long pole; low tech solution

FUTURE WORK

Given the current trend in this technology, low-cost ROVs will likely become even cheaper and more capable. THE STIC will continue to monitor advancement in low-cost ROV technology.

The Science and Technology Innovation Center (STIC) is a DHS S&T and USCG collaboration.